Earth's Structure and Processes

8-3 The student will demonstrate an understanding of materials that determine the structure of Earth and the processes that have altered this structure. (Earth Science)

8.3.6 Explain how the theory of plate tectonics accounts for the motion of the lithospheric plates, the geologic activities at the plate boundaries, and the changes in landform areas over geologic time.
Taxonomy level: 2.7-B Understand Conceptual Knowledge

Previous/future knowledge: The theory of plate tectonics is new material for this grade.

It is essential for students to know that the theory of plate tectonics explains why and how large sections of Earth's crust, called *lithospheric plates*, move. A hypothesis of continental drift was developed before the present theory of plate tectonics. It was based on continent shape, fossil evidence, rock, and climate clues. This hypothesis later led to the theory of plate tectonics when evidence was found as to why the plates could move. Plate tectonics explains how many Earth features form.

Motion of the Lithospheric Plates
- Plates float on the upper part of the mantle.
- Convection currents can cause the asthenosphere to flow slowly carrying with it the plates of the lithosphere.
- This movement of plates changes the sizes, shapes, and positions of Earth's continents and oceans.

Geologic Activities at Plate Boundaries
Divergent boundary—where two plates are moving apart
- most located along mid-ocean ridge (sea-floor spreading);
- new crust forms because magma pushes up and hardens between separating plates.

Convergent boundary—where two plates come together and collide
- activity depends upon the types of crust that meet;
- more dense oceanic plate slides under less dense continental plate or another oceanic plate – *subduction zone*, some crust is destroyed;
- two continental plates converge, both plates buckle and push up into mountain ranges;

Transform boundary—where two plates slide past each other
- crust is neither created nor destroyed;
- earthquakes occur frequently along this type of boundary.

Changes in Landform areas over Geologic Time
- Plates move at very slow rates – from about one to ten centimeters per year;
- At one time in geologic history the continents were joined together in one large landmass that was called Pangaea.
- As the plates continued to move and split apart, oceans were formed, landmasses collided and split apart until the Earth's landmasses came to be in the positions they are now;

- Evidence of these landmass collisions and splits comes from fossils, landform shape, features, and rock structures, and climate change;
- Landmass changes can occur at hot spots within lithospheric plates;
- Earth's landmasses will continue to move and change during the geologic time of the future.

It is not essential for students to know name specific plates, but interpreting a world map of plates with direction of motion would be helpful.

Assessment Guidelines:
The objective of this indicator is to *explain* how the theory of plate tectonics accounts for changes in the landforms of Earth; therefore, the primary focus of assessment should be to construct a cause-and-effect model of why the plates move, what type of motion takes place as plates collide, and what changes result in the landforms of Earth. However, appropriate assessments should also require students to *interpret* diagrams that show varying aspects of these factors; *compare* the activities at plate boundaries or the shape/movement of landmasses over time; or *classify* a plate boundary based on the motion of plates and/or landforms that result.